

WHAT IS CLAIMED IS:

1. An apparatus for processing a surface of a substrate, comprising:
 - a chamber that contains a gas atmosphere, the chamber including an inner wall;
 - a substrate holder within the chamber that holds the substrate;
 - a plasma source that generates a plasma by supplying first electromagnetic waves with a first electric power to the gas atmosphere;
 - a bias source that generates a bias voltage by supplying second electromagnetic waves with a second electric power to the substrate holder, charged species in the plasma being accelerated by the bias voltage and directed toward the surface of the substrate so that the surface is processed by the accelerated charged species; and
 - a controller that produces a control signal by monitoring the bias voltage and a ground current that flows from the plasma to the inner wall of the chamber, the control signal being used to control the first electric power.
2. The apparatus according to claim 1, wherein the inner wall is a ground electrode electrically isolated from a remaining portion of the chamber.
3. The apparatus according to claim 2, wherein the ground electrode is replaceable.
4. The apparatus according to claim 1, wherein the controller controls the first electric power and the second electric power using the control signal.
5. An apparatus for processing a surface of a substrate, comprising:
 - a chamber that contains a gas atmosphere, the chamber including an inner wall;
 - a substrate holder within the chamber that holds the substrate;
 - a plasma source that generates a plasma by supplying first electromagnetic waves with a first electric power to the gas atmosphere;
 - a bias source that generates a bias voltage by supplying second electromagnetic waves with a second electric power to the substrate holder, charged species in the plasma being accelerated by the bias voltage and directed toward the surface of the substrate so that the surface is processed by the accelerated charged species; and
 - a controller that controls the first electric power such that the bias voltage is maintained within a selected range by increasing the first electric power

when the bias voltage is higher than a selected upper limit and decreasing the first electric power when the bias voltage is lower than a selected lower limit.

6. An apparatus for processing a surface of a substrate, comprising:
a chamber that contains a gas atmosphere, the chamber including an
5 inner wall;
a substrate holder within the chamber that holds the substrate;
a plasma source that generates a plasma by supplying first
electromagnetic waves with a first electric power to the gas atmosphere, the inner wall
being situated such that reaction products deposit on the inner wall, the reaction
10 products deposited on the inner wall having an influence on the plasma;
a bias source that generates a bias voltage by supplying second
electromagnetic waves with a second electric power to the substrate holder, charged
species in the plasma being accelerated by the bias voltage and directed toward the
surface of the substrate so that the surface is processed by the accelerated charged
15 species; and
a controller that controls the first electric power to compensate the
influence of the reaction products deposited on the inner wall, wherein:
the controller monitors an amount of the reaction products deposited
on the inner wall by monitoring the bias voltage; and
20 the controller decreases the first electric power when an increase in the
amount of the reaction products is monitored and increases the first electric power
when a decrease in the amount of the reaction products is monitored.
7. The apparatus according to claim 6, wherein the controller monitors
the amount of the reaction products by monitoring the bias voltage and a ground
25 current that flows from the plasma to the inner wall.
8. The apparatus according to claim 7, wherein the inner wall is a ground
electrode electrically isolated from a remaining portion of the chamber.
9. An apparatus for processing a surface of a substrate, comprising:
means for holding the substrate on a substrate holder in a chamber, the
30 chamber including an inner wall;
means for generating a plasma by supplying first electromagnetic
waves with a first electric power to a gas atmosphere within the chamber;
means for applying a bias voltage to the substrate by supplying second
electromagnetic waves with a second electric power to the substrate holder so that the

surface of the substrate is processed by charged species in the plasma accelerated by the bias voltage;

means for monitoring the bias voltage and a ground current that flows from the plasma to the inner wall of the chamber to produce a control signal; and

5 means for controlling the first electric power using the control signal.

10. A method for processing a surface of a substrate, comprising:

holding the substrate on a substrate holder in a chamber, the chamber including an inner wall;

10 generating a plasma by supplying first electromagnetic waves with a first electric power to a gas atmosphere within the chamber;

applying a bias voltage to the substrate by supplying second electromagnetic waves with a second electric power to the substrate holder so that the surface of the substrate is processed by charged species in the plasma accelerated by the bias voltage;

15 monitoring the bias voltage and a ground current that flows from the plasma to the inner wall of the chamber to produce a control signal; and

controlling the first electric power using the control signal.

11. The method according to claim 10, wherein the controlling comprises controlling the first electric power and the second electric power using the control signal.

12. The method according to claim 10, wherein the inner wall is a ground electrode electrically isolated from a remaining portion of the chamber.

13. A method for processing a surface of a substrate, comprising:
25 holding the substrate on a substrate holder in a chamber, the chamber including an inner wall;

generating a plasma by supplying first electromagnetic waves with a first electric power to a gas atmosphere within the chamber;

30 applying a bias voltage to the substrate by supplying second electromagnetic waves with a second electric power to the substrate holder so that the surface of the substrate is processed by charged species in the plasma accelerated by the bias voltage;

controlling the first electric power, including increasing the first electric power when the bias voltage is higher than a selected upper limit, and

decreasing the first electric power when the bias voltage is lower than a selected lower limit.

14. A method for processing a surface of a substrate, comprising:

 - holding the substrate on a substrate holder in a chamber, the chamber
 - including an inner wall;
 - generating a plasma by supplying first electromagnetic waves with a first electric power to a gas atmosphere within the chamber;
 - applying a bias voltage to the substrate by supplying second electromagnetic waves with a second electric power to the substrate holder so that the surface of the substrate is processed by charged species in the plasma accelerated by the bias voltage;
 - controlling the first electric power to maintain the bias voltage within a selected range; and
 - when the bias voltage is not maintained within the selected range,
 - controlling the second electric power to maintain the bias voltage within the selected range.
15. A method for processing a surface of a substrate, comprising:

 - holding the substrate on a substrate holder in a chamber, the chamber having an inner wall;
 - generating a plasma by supplying first electromagnetic waves with a first electric power to a gas atmosphere within the chamber;
 - applying a bias voltage to the substrate by supplying second electromagnetic waves with a second electric power to the substrate holder so that the surface of the substrate is processed by charged species in the plasma accelerated by the bias voltage;
 - controlling the first electric power and the second electric power, including:
 - a) monitoring the bias voltage and a ground current that flows from the plasma to the inner wall; and
 - b) when the bias voltage is outside of a first selected range and the ground current is outside of a second selected range, changing the first electric power.
16. The method according to claim 15, wherein the controlling further comprises changing the second electric power when the bias voltage is outside of the first selected range and the ground current is within the second selected range.

17. The method according to claim 15, wherein the inner wall of the chamber is a ground electrode electrically isolated from a remaining portion of the chamber.

18. A method for successively processing a plurality of substrates in a chamber, comprising:

holding one of the plurality of the substrates on a substrate holder within the chamber, the chamber including an inner wall;

generating a plasma by supplying first electromagnetic waves with a first electric power to a gas atmosphere within the chamber;

applying a bias voltage to the substrate by supplying second electromagnetic waves with a second electric power to the substrate holder so that the surface of the substrate is processed by charged species in the plasma accelerated by the bias voltage;

depositing reaction products on the inner wall of the chamber, the reaction products deposited on the inner wall having an influence on the plasma;

monitoring an amount of the reaction products deposited on the inner wall by monitoring the bias voltage; and

controlling the first electric power to compensate the influence of the reaction products, including decreasing the first electric power when an increase in the amount of the reaction products is monitored, and increasing the first electric power when a decrease in the amount of the reaction products is monitored.

19. The method according to claim 18, wherein the monitoring monitors the amount of the reaction products by monitoring the bias voltage and a ground current that flows from the plasma to the inner wall.

20. The method according to claim 19, wherein the inner wall of the chamber is a ground electrode electrically isolated from a remaining portion of the chamber.

21. A method of monitoring deposition of reaction products on an inner wall of a chamber, comprising:

generating a plasma by supplying first electromagnetic waves with a first electric power to a gas atmosphere within the chamber, the chamber including an inner wall;

depositing reaction products on the inner wall of the chamber; and

22. The method according to claim 21, wherein the inner wall of the chamber is a ground electrode electrically isolated from a remaining portion of the chamber.

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Case	Age	Sex	Site	Pathologic	Survival
1	65	M	Rectum	Adenocarcinoma	10 years
2	68	M	Rectum	Adenocarcinoma	12 years
3	72	M	Rectum	Adenocarcinoma	15 years
4	75	M	Rectum	Adenocarcinoma	18 years
5	78	M	Rectum	Adenocarcinoma	20 years
6	80	M	Rectum	Adenocarcinoma	22 years
7	82	M	Rectum	Adenocarcinoma	25 years
8	85	M	Rectum	Adenocarcinoma	28 years
9	88	M	Rectum	Adenocarcinoma	30 years
10	90	M	Rectum	Adenocarcinoma	32 years
11	92	M	Rectum	Adenocarcinoma	35 years
12	95	M	Rectum	Adenocarcinoma	38 years
13	98	M	Rectum	Adenocarcinoma	40 years
14	100	M	Rectum	Adenocarcinoma	42 years
15	102	M	Rectum	Adenocarcinoma	45 years
16	105	M	Rectum	Adenocarcinoma	48 years
17	108	M	Rectum	Adenocarcinoma	50 years
18	110	M	Rectum	Adenocarcinoma	52 years
19	112	M	Rectum	Adenocarcinoma	55 years
20	115	M	Rectum	Adenocarcinoma	58 years
21	118	M	Rectum	Adenocarcinoma	60 years
22	120	M	Rectum	Adenocarcinoma	62 years
23	122	M	Rectum	Adenocarcinoma	65 years
24	125	M	Rectum	Adenocarcinoma	68 years
25	128	M	Rectum	Adenocarcinoma	70 years
26	130	M	Rectum	Adenocarcinoma	72 years
27	132	M	Rectum	Adenocarcinoma	75 years
28	135	M	Rectum	Adenocarcinoma	78 years
29	138	M	Rectum	Adenocarcinoma	80 years
30	140	M	Rectum	Adenocarcinoma	82 years
31	142	M	Rectum	Adenocarcinoma	85 years
32	145	M	Rectum	Adenocarcinoma	88 years
33	148	M	Rectum	Adenocarcinoma	90 years
34	150	M	Rectum	Adenocarcinoma	92 years
35	152	M	Rectum	Adenocarcinoma	95 years
36	155	M	Rectum	Adenocarcinoma	98 years
37	158	M	Rectum	Adenocarcinoma	100 years
38	160	M	Rectum	Adenocarcinoma	102 years
39	162	M	Rectum	Adenocarcinoma	105 years
40	165	M	Rectum	Adenocarcinoma	108 years
41	168	M	Rectum	Adenocarcinoma	110 years
42	170	M	Rectum	Adenocarcinoma	112 years
43	172	M	Rectum	Adenocarcinoma	115 years
44	175	M	Rectum	Adenocarcinoma	118 years
45	178	M	Rectum	Adenocarcinoma	120 years
46	180	M	Rectum	Adenocarcinoma	122 years
47	182	M	Rectum	Adenocarcinoma	125 years
48	185	M	Rectum	Adenocarcinoma	128 years
49	188	M	Rectum	Adenocarcinoma	130 years
50	190	M	Rectum	Adenocarcinoma	132 years
51	192	M	Rectum	Adenocarcinoma	135 years
52	195	M	Rectum	Adenocarcinoma	138 years
53	198	M	Rectum	Adenocarcinoma	140 years
54	200	M	Rectum	Adenocarcinoma	142 years
55	202	M	Rectum	Adenocarcinoma	145 years
56	205	M	Rectum	Adenocarcinoma	148 years
57	208	M	Rectum	Adenocarcinoma	150 years
58	210	M	Rectum	Adenocarcinoma	152 years
59	212	M	Rectum	Adenocarcinoma	155 years
60	215	M	Rectum	Adenocarcinoma	158 years
61	218	M	Rectum	Adenocarcinoma	160 years
62	220	M	Rectum	Adenocarcinoma	162 years
63	222	M	Rectum	Adenocarcinoma	165 years
64	225	M	Rectum	Adenocarcinoma	168 years
65	228	M	Rectum	Adenocarcinoma	170 years
66	230	M	Rectum	Adenocarcinoma	172 years
67	232	M	Rectum	Adenocarcinoma	175 years
68	235	M	Rectum	Adenocarcinoma	178 years
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